What is claimed is:

1. A method for projecting a superimposed image onto a target display surface under observation of at least one camera, the method comprising the steps of:

(a) determining a projective relationship between each of a plurality of projectors and the target display surface;

(b) estimating a component image for each said projector, comprising:

(1) using said projective relationship, for each of said component images determine a plurality of sub-sampled, regionally shifted images represented in the frequency domain; and

(2) composing each said component image using a respective plurality of said sub-sampled, regionally shifted images; and

(c) minimizing the difference between a sum of said component images and a frequency domain representation of a target image to produce a second component image for each said projector.

2. The method of claim 1 wherein said step of minimizing the difference between said sum and said frequency domain representation of said target image comprises: **(a)** identifying a second set of frequency domain coefficients for use in producing a frequency domain representation of said second component image for a respective one of said projectors, and **(b)** taking the inverse Fourier transform of said frequency domain representation of said second component image for said respective one of said projectors; and further comprising the step of projecting from each said projector, a respective one of said second component images to produce the superimposed image.

3. The method of claim 1 wherein said step of determining a projective relationship further comprises:

(a) observing the target display surface with the camera, **c**;

(b) recovering a homography between each projector, pi, and the camera, H_{pi}^{c}, and

(c) using said homography, H_{pi}^{c}, determine said projective relationship, H_{pi}^{b}, wherein **b** represents a reference frame for the target display surface.

4. The method of claim 2 wherein said step of using said projective relationship to determine said plurality of sub-sampled, regionally shifted images, comprises: **(a)** decomposing each said projective relationship, H_{pi}^{b}, into a linear shift matrix representing offsets between a respective of said projectors p*i*, and said reference frame b; and **(b)** using said linear shift matrix for said determining said plurality of sub-sampled, regionally shifted images associated with said respective of said projectors p*i*.

5. The method of claim 1 wherein said step of minimizing the difference between said sum and said frequency domain representation of said target image, $F_T[u,v]$, comprises:

(a) minimizing the expression:

$$\left\| F_T[u,v] - \left(\sum_{i=0}^{k} F_\Delta^i[u,v] \right) \right\|^2$$

wherein ***k*** represents the total number of said plurality of projectors, said component image for each said projector is represented by $F_\Delta^p[u,v] = \sum_{r=0}^{N} F_{\Delta r}[u,v]$, and said sub-sampled, regionally shifted images represented in the frequency domain are represented by $F_{\Delta r}[u,v]$, to identify a second set of frequency domain coefficients for use in producing a frequency domain representation of said second component image for a respective one of said projectors; and

(b) taking the inverse Fourier transform of said frequency domain representation of said second component image for said respective one of said projectors.

6. A system for projecting the superimposed image onto the target display surface, of claim 1, wherein: being projected from each said projector, is a respective one of said second component images to produce the superimposed image.

7. A method for projecting a superimposed image onto a target display surface under observation of at least one camera, the method comprising the steps of:

(a) determining a projective relationship between each of a plurality of projectors and the target display surface;

(b) estimating a component image for each said projector, comprising:

(1) using said projective relationship, for each of said component images determine a plurality of sub-sampled, regionally shifted images represented in the frequency domain, and

(2) composing each said component image using a respective plurality of said sub-sampled, regionally shifted images; and

(c) performing an optimization using said component images and a frequency domain representation of a target image to produce a second component image for each said projector.

8. The method of claim 7 wherein:

(a) said step of performing an optimization comprises minimizing the difference between a sum of said component images and said frequency domain representation of said target image, $F_T[u,v]$, to produce said second component image for each said projector; and

(b) said step of determining a projective relationship further comprises:

(1) observing the target display surface with the camera, **c**;

(2) recovering a homography between each projector, pi, and the camera, $\mathrm{H}^{\mathrm{c}}_{\mathrm{p}i}$; and

(3) using said homography, $\mathrm{H}^{\mathrm{c}}_{\mathrm{p}i}$, determine said projective relationship, $\mathrm{H}^{\mathrm{b}}_{\mathrm{p}i}$, wherein **b** represents a reference frame for the target display surface.

9. The method of claim 8 wherein said step of performing an optimization comprises minimizing the difference between a sum of said component images and said frequency domain representation of said target image, $F_T[u,v]$, by minimizing the expression:

$$\left\| F_T[u,v] - \left(\sum_{i=0}^{k} F^i_\Delta[u,v] \right) \right\|^2$$

wherein ***k*** represents the total number of said plurality of projectors, said component image for each said projector is represented by $F^p_\Delta[u,v] = \sum_{r=0}^{N} F_{\Delta r}[u,v]$, and said sub-sampled, regionally shifted images represented in the frequency domain are represented by $F_{\Delta r}[u,v]$, to identify a second set of frequency domain coefficients for use in producing a frequency

domain representation of said second component image for a respective one of said projectors.

10. A system for projecting the superimposed image onto the target display surface, of claim 7, wherein: being projected from each said projector, is a respective one of said second component images to produce the superimposed image.

11. A computer executable program code on a computer readable storage medium for projecting a superimposed image onto a target display surface under observation of at least one camera, the program code comprising:

(a) a first program sub-code for determining a projective relationship between each of a plurality of projectors and the target display surface;

(b) a second program sub-code for estimating a component image for each said projector, said second program sub-code comprising instructions for:

(1) using said projective relationship, for each of said component images determine a plurality of sub-sampled, regionally shifted images represented in the frequency domain; and

(2) composing each said component image using a respective plurality of said sub-sampled, regionally shifted images; and

(c) a third program sub-code for minimizing the difference between a sum of said component images and a frequency domain representation of a target image to produce a second component image for each said projector.

12. The program code of claim 11 wherein said frequency domain representation of said target image as $F_T[u,v]$, and said third program sub-code comprises instructions for:

(a) minimizing the expression:

$$\left\| F_T[u,v] - \left(\sum_{i=0}^{k} F_\Delta^i[u,v] \right) \right\|^2$$

wherein ***k*** represents the total number of said plurality of projectors, said component image for each said projector is represented by $F_\Delta^p[u,v] = \sum_{r=0}^{N} F_{\Delta r}[u,v]$, and said sub-sampled, regionally shifted images represented in the frequency domain are represented by $F_{\Delta r}[u,v]$, to identify a second set of frequency domain coefficients for

use in producing a frequency domain representation of said second component image for a respective one of said projectors; and

(b) taking the inverse Fourier transform of said frequency domain representation of said second component image for said respective one of said projectors.

13. A computer executable program code on a computer readable storage medium for projecting a superimposed image onto a target display surface under observation of at least one camera, the program code comprising:

(a) a first program sub-code for determining a projective relationship between each of a plurality of projectors and the target display surface;

(b) a second program sub-code for estimating a component image for each said projector, said second program sub-code comprising instructions for:

(1) using said projective relationship, for each of said component images determine a plurality of sub-sampled, regionally shifted images represented in the frequency domain; and

(2) composing each said component image using a respective plurality of said sub-sampled, regionally shifted images; and

(c) a third program sub-code for performing an optimization using said component images and a frequency domain representation of a target image to produce a second component image for each said projector.

14. The program code of claim 13 wherein:

(a) said third program sub-code comprises instructions for minimizing the difference between a sum of said component images and said frequency domain representation of said target image to produce said second component image for each said projector; and

(b) said first program sub-code comprises instructions for, while observing the target display surface with the camera, **c**, recovering a homography between each projector, p*i*, and the camera, H_{pi}^{c}; and using said homography, H_{pi}^{c}, determining said projective relationship, H_{pi}^{b}, wherein **b** represents a reference frame for the target display surface.